LANSCE
Los Alamos Neutron Science Center

Research Proposal for the use of Neutron Science Facilities

☐ Fast Access ☐ Joint CINT Proposal

Proposal Number: 20111537
Submission Number: S1568
Date Received: 03/09/11

Program Advisory Subcommittee: Materials Science
Focus Area:

Flight Path/Instrument: 1FP05-A / ER1
Estimated Beam Time (days): 30
Days Recommended: 0
Dates Desired:
Impossible Dates:

TITLE
Installation and testing of a Neutron Computed Tomography Instrument on 1FP5

☐ Continuation of Proposal #:

☐ Ph.D Thesis for:

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RESEARCH AREA

- ☐ Biological and Life Science
- ☐ Chemistry
- ☐ National Security
- ☐ Earth Sciences
- ☐ Engineering
- ☐ Environmental Sciences
- ☐ Nuc. Physics/chemistry
- ☐ Astrophysics
- ☐ Few Body Physics
- ☐ Fund. Physics
- ☐ Elec. Device Testing
- ☐ Dosimetry/Med/Bio
- ☐ Earth/Space Sciences
- ☒ Materials Properties/Test
- ☐ Other:
- ☐ Mat'l Science (incl Cond Matter)
- ☐ Medical Applications
- ☐ Nuclear Physics
- ☐ Polymers
- ☐ Physics (Excl Condensed Matter)
- ☒ Instrument Development
- ☐ Neutron Physics
- ☐ Fission
- ☐ Reactions
- ☐ Spectroscopy
- ☐ Nuc. Accel. Reactor Eng.
- ☐ Def. Science/Weapons Physics
- ☒ Radiography
- ☐ Threat Reduction/Homeland Sec.
- ☐ Other:

FUNDING AGENCY

- ☐ DOE/BES
- ☐ DOE/OBER
- ☐ DOE/NNSA
- ☒ DOE/NE
- ☐ DOE/SC
- ☐ DOE/Other
- ☐ DOD
- ☐ NSF
- ☐ Industry
- ☐ NASA
- ☐ NIH
- ☐ Foreign:
- ☐ Other US Gov't:
- ☐ Other:

PUBLICATIONS

Publications:

NONE

Abstract: S1568_Neutron_Comp.pdf

By electronic submission, the Principal Investigator certifies that this information is correct to the best of their knowledge.

Safety and Feasibility Review*(to be completed by LANSCE Instrument Scientist/Responsible)*

☐ **No further safety review required** ☐ **To be reviewed by Experiment Safety Committee**

☐ **Approved by Experiment Safety Committee,Date:**

Recommended # of days:	**Change PAC Subcommittee and/or Focus Area to:**	**Change Instrument to:**

Comments for PAC to consider:

Instrument scientist signature: **Date:**

Installation and testing of a Neutron Computed Tomography Instrument on 1FP5

Thomas Claytor (AET-6), James Hunter (AET-6), Fredrik Tovesson (LANSCE-NS), James Carey (EES-14), Hongwu Xu (EES-14)

Multi Program Use:

We are proposing to develop a dedicated neutron computed tomography/radiography instrument capability at LANSCE on Flight Path 5. This flight path is ideal as it is underutilized and has the required flux to obtain digital images in less than a second. We envision this capability as a user facility for LANSCE in much the same way as the rest of the facility is organized. LANSCE has a number of instruments that measure microscopic/atomistic changes in materials but few that can sense global changes in materials over mm or larger length scales. In the planning for MaRIE, neutron tomography has been proposed and this instrument can be considered a precursor to a similar instrument that could be added to that facility.

In the past, we have had digital radiography and limited computed tomography capability at LANSCE but have not had continuous organizational or flight-path support for this activity. Thus the beam lines have not been maintained in a suitable configuration or the equipment readily available. This makes neutron tomography at LANL an expensive and time consuming process for an individual program. It is our intension to create a state-of-the-art system on Flight Path 5 so that computed tomography/radiography can be easily performed by visitors with support from the instrument scientist similar to the other flight paths. Currently, we are performing neutron computed tomography imaging on flight path 5 on rock cores to investigate CO_2 sequestration in-situ based on an LDRD-DR project. Previously, we have used this flight path to produce digital radiographic videos of hydrogen loaded getter components and to extract loading fractions from these images. Also, Sandia has collaborated with our group to investigate the application of neutron computed tomography for the assessment of the quality of certain ceramic components. Carbon graphite materials are difficult to inspect with x-rays because of the low density/attenuation but are perfect specimens for neutron radiography but because of the current limitations of the flight path this stockpile investigation cannot be done at Los Alamos. No facilities exist in the Southwest to provide this type of service at the resolution speed we anticipate that this instrument will provide.

Expertise:

Our team was the first to apply electronic digital imaging panel techniques at LANSCE to produce the first computed tomographic images at this facility and the first to demonstrate that flat panel detectors with the appropriate scintillators would survive in a neutron beam for extended periods of time. This was the subject of an invited talk at a neutron imaging conference. Our team has extensive expertise in high resolution computed tomographic reconstruction code and has extended the state-of-the-art for multi-material discrimination. All the computed tomographic data we collect can be visualized in 3D and we have experience with several 3D visualization software packages. AET-6 currently has five operational x-ray computed tomographic systems that support a broad cross section of laboratory missions. AET-6 also has a portable CT detection system that has been used in the field (literally at a firing site) and most recently at LANSCE on Flight Path 5. In addition, AET-6 has a patent on a low scatter large area detector that will be useful for the proposed system. The team is experienced in the task of specifying and installing a computed tomography system at LANSCE. Our track record includes an R&D 100 award for the invention of this type of imaging modality.

Our LANSCE collaborators are familiar with the beam line and the modifications (to the collimation) that are required for the beam to upgrade this beam line for imaging purposes. One of the reasons that resolution was limited on recent neutron CT images was that there was insufficient collimation ahead of the neutron shutter.